



ENGINEERING MAINTENANCE BRANCH BULLETIN

Issue # 010

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This is the engineering maintenance management bulletin to MSC ships and shoreside personnel. The purpose of the bulletin is to inform all concerned of current COMSC Preventive Maintenance management practices associated with any new or revised policy and procedures, along with helpful tips & tricks for improved maintenance. The bulletin will also discuss and present any upcoming initiatives in the various programs.

We continue our efforts to bring you useful information with the page dedicated to the Vibration Monitoring System (VMS). This will have useful tips as well as past case histories.

PICTURE OF THE MONTH - WE NEED YOUR PICTURES!!

It is said, “A picture’s worth a thousand words!” If you have pictures of Shipboard Maintenance (Vibration Monitoring, Oil Sampling, machinery upkeep, etc.) being performed, or a visit from a SAMM or VMS Tech Rep, please send them (along with a *brief* narrative as to what the picture is about) to Norm Wolf (e-mail: Norman.wolf@navy.mil).



USNS GRASP (T-ARS 51) undergoes a post-turnover Repair Availability at Detyen’s Shipyard in Charleston, SC. Seaworthy System’s Andrew Tierney along with MSC’s Norm Wolf visited the vessel to perform an initial check of ship’s equipment for SAMM Database development and discuss the installation schedule for SAMM and the Vibration Monitoring System (VMS).

SAMM/Maintenance Tips

Alignment Tip - DOCUMENTATION: When performing shaft alignments, having a detailed history of the alignment improves communication between those involved with solving and approving the alignment. The best alignment systems automatically record alignment readings and moves in a measurement table. This is ideal for record keeping. Additionally, it is good practice to keep a detailed log of the shim corrections performed. By doing this, each shim correction can be tracked to avoid having stacks of shims installed under each foot (it's recommended to keep no more than 3-4 shims under each foot). If needed, steps can be taken to reverse the shim corrections should the alignment end up going in a direction that was not planned. Murphy's Law: If anything can go wrong, it will.

-Tip provided by LUDECA, INC.

Electrical Safety Tip: Always double-check your circuit voltage tester before and after using it prior to working on anything electrical, to make sure it is de-energized. Remember, a non-working tester says its dead and then you might be for not double-checking the tester!

-Tip provided by Jim Zuidema, Electrician, Alcoa, Bettendorf, IA



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SAMM Changes

A step toward reliability based maintenance.

(By Will Carroll, Sr. Mechanical Engineer)

N7 will be modifying SAMM to incorporate changes that allow MSC to determine the effectiveness of its planned, predictive and preventive maintenance activities. Considering the purpose of these maintenance activities is to delay, prevent or predict the onset of equipment failure, we must first collect information on the circumstances surrounding equipment failures. The second step in determining the effectiveness of our planned, predictive and preventive maintenance activities is to review the information and determine if the maintenance plan performed as intended and if not is there sufficient consequence associated with the failure to warrant a change in our maintenance plan. The third step is to change the maintenance plan when warranted. After this, the process would then start again with the monitoring of equipment failures to determine if the changes to the maintenance plan are effective.

Documenting Failures

In order to determine how to prevent a specific failure, MSC must understand what failed and the likely cause (or causes) of the failure. Yes, there may be one or more causes for a single equipment failure. For instance, a pump may experience both over-lubrication and misalignment prior to a bearing failure. They are both probable causes for the failure. If one were to perform a metallurgic analysis, you could possibly eliminate one of the causes. MSC does not have the resources to identify the exact root causes for every failure that occurs in the fleet, but the knowledge that our shipboard and shoreside engineers possess allow us to identify the probable causes for the failures. Once we have determined what we suspect the causes of our failure to be, ship and shoreside engineers must document this information to allow for future retrieval and analysis. SAMM will be modified to become *the source* for documenting all equipment failures.

Presently, failures are documented in SAMM as Ships' Force Work List Items (SFWL), Voyage Repair Requests (VRRs) or Generic SAMM Machinery History entries with out information regarding probable cause of the failure, resources and parts used. Currently, SAMM has the capability to attach files and associate parts with SFWLs and VRRs but it does not allow the user to simply enter the number of parts used, select a probable cause for the failure, or enter the number of man hours expended against the repair once it has been completed.

Some failures are documented in the Type Desk Readiness Management System (TRMS) as a Casualty Report (CASREP). These failures are typically entered in SAMM as generic SAMM Machinery History entry after the repair has been completed. Again, SAMM does not

provide the capability to enter the parts used, select a probable cause for the failure, or enter the number of man-hours expended against the repair once it has been completed.

The missing data elements and inability to retrieve the complete information related to equipment failures, hampers MSC's ability to effectively perform a basic function necessary for maintenance engineering. The lack of this capability was documented in a review of the SAMM system performed by Life Cycle Engineering in June 2004 for the N7 Maintenance Excellence initiative. A copy of this report can be obtained by e-mailing a request to William.S.Carroll@navy.mil. Beginning with SAMM Service Pack 2 (SP2), MSC will have a Maintenance Management program with the necessary functionality to begin capturing the missing data.

Reviewing the information

When discussing data, the question always comes up as to who will be looking at the data. Data in context provides information. In order for a review to be effective, accurate data must be pulled from multiple sources and presented to the analyst; the analyst must be familiar with the line of business from which the data is derived; and finally, a logical argument must be presented to the decision makers.

In the short term, the analyst is targeted to be the vessel's Chief Engineers and MSCHQ N7 staff. The types of analysis that are targeted to be performed:

- Identification of equipment requiring abnormally high levels of maintenance ("Bad actors" report)
- Analysis to identify specific repetitive failures
- Comparison of maintenance cost with replacement cost
- Justification and refinement of the Maintenance Plans
- Benchmarking cost of different manufacturers and models that fulfill the same function in the MSC fleet
- Benchmarking MSC maintenance activities against that of other organizations
- Analysis of the return on MSC's predictive maintenance programs on a per machine basis.

Please contact William.S.Carroll@navy.mil or 202-685-5742 if you have any questions or comments.



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Question of the Month: Why does MSC need to analyze the Return on Investment of its Predictive Maintenance Programs?

(By Norm Wolf & Will Carroll)

It's been over 10 years since MSC first introduced Used Lube Oil Analysis and Vibration Analysis into its fleet. Periodically, MSC will review and publish information on cost avoidance attributed to these two predictive technologies. Typically, this requires that someone goes back and search through machinery history to determine if a repair was performed sometime within six months after an alert was generated from one of the Predictive Maintenance programs. If no information can be found, then the engineer doing the analysis will ask the ship's Chief Engineer for information regarding actions taken with respect to the alert in question. It is a 50/50 chance that the Chief Engineer that received the alert remembers or was even on the ship when the repair took place. During the course of such a review, we will often find that there is equipment in the program where the test conditions were not met and thus the alert results were not actionable.

MSC pays in two ways each time a vibration or lube oil maintenance action is performed. First, in the labor expended collecting the data and second in the time spent by shoreside support staff performing the analysis of the data. So, what is MSC's return on its predictive maintenance programs? MSC gains value when the recommendations from the programs are combined with deck-plate knowledge in determining actions required to prevent the catastrophic failure of equipment or to proactively repair any machines already demonstrating potential failure.

How do you determine when action was taken on a recommendation and if the recommendation was accurate? In order to do this, we will have to understand exactly who is reviewing the recommendations and the actions that may be taken as a result of the recommendations. We also will have to ensure that once the action is taken, the results of the action are documented as part of machinery history. The beginning of this type of data collection will be present in the next release of SAMM.

SAMM will have the capability to initiate a SFWL or VRR from a Vibration or Lube Oil Recommendation. The Chief or First Engineer can then create a machinery history entry when the repair item is completed. It is at this point when the conditions found can be entered with information validating or invalidating the recommendation. This combined with the labor and part information for the repair will provide the necessary information to determine MSC's return on its predictive

maintenance program. (This is the initial response to tracking action on a condition-based alert. We recognize that initiating a repair is only one of the actions that may result from the review of the recommendations and we are working to determine how best to incorporate the other actions into the software.)

Given that corrective maintenance will be initiated when a fault is detected and followed through to completion of the work, we can use the data to implement a continual analysis of the return on predictive maintenance programs. A continual analysis of the return on predictive maintenance programs can benefit MSC in many ways five of which are listed below:

1. Removing the testing requirement from the equipment's maintenance plan when accurate recommendations cannot be obtained for the failure modes the technology is intended to detect on that equipment.
2. Modifying the logic used by the analyst (be it a human or an Expert System) to improve the accuracy of the diagnosis.
3. Adding equipment to the program when a failure mode that is detectable by a predictive technology occurs frequently enough to offset the cost of setting up the equipment in the program.
4. Extending out the frequency of vibration or lube oil maintenance actions when the failure rates on the equipment are low and the occurrences of repair recommendations from the predictive technologies are low. (If the test results are always good and the equipment doesn't fail, then maybe we can test it less frequently. Freeing up resources to do something else.)
5. Identifying those cases where the technology is effective at predicting specific failure modes and ensure that the technology is applied to all the equipment in the fleet where the configuration is the same.

For more information, or if you have any questions/comments, contact Will Carroll (William.s.carroll@navy.mil).

Engineering Maintenance Branch Website – something old is new again!!

The Engineering Maintenance Branch web page continues to get a bit of a facelift; along with some helpful downloads (SAMM, PENG, EASy overviews, OAS Guide, *past issues of our bulletin*, etc.), the latest CMEC Class information and who to contact for questions or comments regarding MSC Engineering. Maintenance. For helpful updates, keep checking it out!

<http://www.msc.navy.mil/n7/engmgmt/engmgmt.htm>



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N711 – Points of Contact:

(cut it out & keep it handy!)

Branch Head – Randy Torfin, (202) 685-5744
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Norm Wolf, (202) 685-5778
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Mechanical Engineers – Liem Nguyen, (202) 685-5969 (liem.nguyen@navy.mil) & Andrew Shaw, (202) 685-5721
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Electrical Engineer – David Greer (202) 685-5738 (David.Greer1@navy.mil)

CMEO Training – What Are YOU Waiting For????

CMEO (CIVILIAN MARINE ENGINEERING OFFICER) is a two-week training course (held *quarterly*) at the Naval Supply Corps School in Athens, GA. It is for both shipboard and shoreside engineers. The Engineering Directorate (N7) of Military Sealift Command hosts the course and encourages **ALL** MSC Engineers (3rd A/Es through Chief Engineers, as well as Port Engineers and Project Engineers) to attend (**Note: MSC shipboard engineers are given priority when classes are full**).

CMEO provides training on an array of topics such as: SAMM (Condition Monitoring, Maintenance Scheduling and Repair, Diesel Engine Analysis, Logbook, etc.), Vibration Monitoring, Lube Oil, Fuel Oil (NEURS), Chemicals (boiler treatment, sewage treatment, etc.), Supply (COSAL, ShipCLIP), Environmental, and Safety. SAMM is interactively taught using actual data and each module is discussed extensively.

Upcoming CY '06 class dates:

- April 17-28, 2006 ← **Filling up fast!**
- July 10-21, 2006
- December 04-15, 2006

For further information and to sign up, please go to the CMEO website:

<http://63.219.124.12/cmeoclasssignup/cmeo.htm>

Or contact Dave Greer (david.greer1@navy.mil) with any questions.



AND THE WINNER FOR BEST CATEGORY IS... FEEDBACK!

With each issue, we get more and more requests for the newsletters, from both shoreside AND shipboard engineers, so we know you're reading them. Now, tell us what you think! Feedback is *ESSENTIAL* to making this a helpful bulletin to all shipboard personnel in doing your job "smarter not harder". Please pass on ***any and all*** feedback from your Engine Department.

Not just Junk mail

JUNK MAIL: You don't want it; we don't want to create it. Make this **YOUR** Maintenance Management Bulletin. If there's a SAMM or Maintenance tip, topic, question, suggestion, or comment on how to make this useful, or something relating to Engineering Maintenance you think should get out to the ships, please pass it on. Send your submission to Randy Torfin (randel.torfin@navy.mil) **OR** Norm Wolf (norman.wolf@navy.mil).

COMING UP FOR NEXT ISSUE!

New SAMM/Maintenance Tips!
Another Question of the Month
More Maintenance Management Issues
A New Picture of the Month!
Vibration Monitoring Tips & Information



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Calibration Issues with VMS

(By Mike Johnson, DLI Engineering)

The test equipment used for measuring vibration signatures must meet the same criteria as any electronic test equipment with regard to calibration. There are two components that require frequent calibration verification. This article will discuss calibration issues as they relate to the tri-axial accelerometer and the portable data collector used within VMS.

TRI-AXIAL ACCELEROMETER

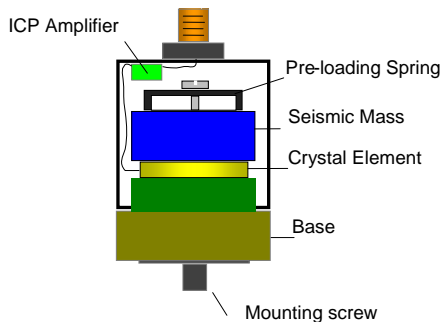


Figure 1. Accelerometer construction

The sensor used with VMS actually has three accelerometers similar to the one shown in Figure 1. When the seismic mass moves relative to the base, the crystal element is placed in either tension or compression. The crystal responds to these forces by creating a charge (+ or -) that is then boosted by the ICP amplifier and sent to the data collector for further signal processing. To get valid results with VMS, each accelerometer must produce 100 mv/g while vibrating at any frequency between 2 and 6000 Hz.

It is not possible for shipboard personnel to verify accelerometer calibration. This can only be done by placing the sensor on a shaker table alongside a reference accelerometer (mounted on the same shaker) and comparing their outputs. By design accelerometers are moderately rugged and in practice do not generally drift out of calibration. When the crystal element is damaged, the spectral data will show as a flat line with either very low amplitude (like 20 VdB) or very high amplitude (like 150 VdB). The accelerometer has a calibration decal attached that states the last time it was placed on a shaker and had its sensitivity verified. If your sensor has a calibration date beyond three years or you suspect that it may be damaged contact DLI Engineering for a replacement. See DLI contact info below.

VMS PORTABLE DATA COLLECTOR

The portable data collector used within VMS is responsible for processing the signals from the three accelerometers and storing the processed data in memory so it can be uploaded to SAMM for Expert System

Analysis. The signal processing includes several filters; an analog to digital converter, an integrator, and a Fast Fourier transform processor to perform the discrete Fourier analysis. The final result is a velocity vibration spectrum from each accelerometer in the tri-axial cluster. The data collector circuitry is subject to error and therefore its calibration should be verified annually.

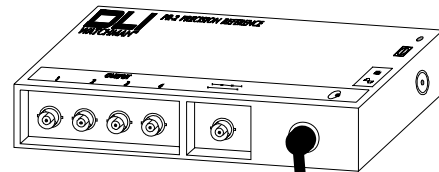


Figure 2. Precision Reference Signal Generator

To avoid having each ship give up its data collector once per year for this calibration check each ship is equipped with a Precision Reference signal generator (PR-1) as shown in Figure 2. The PR-1 has three channels of output similar to the tri-axial accelerometer. Its output is 5 sine waves at 50, 100, 200, 250, and 300 Hz, each with amplitude 122.8 VdB. This signal generator must have its calibration verified annually.

CALIBRATION REMINDER

The SAMM PM Module has a quarterly check that requires each ship to observe the calibration decal of its PR-1 and accelerometer. When the calibration is due send an email to DLI Engineering stating that you will be sending your equipment in for calibration. If possible please provide a fixed shipping address so that the newly calibrated equipment can be returned.

LOGISTICS

DLI Engineering (SAMM Contractor) is tasked with maintaining a pool of spare accelerometers, PR-1's, and Data Collectors. The cost to purchase a new PR-1 is \$1695 and the tri-axial accelerometer cost is \$1250. If every ship were to keep *just one additional* PR-1 and accelerometer, the cost to MSC would be **over \$200,000!** This also depletes the pool of replacements, delaying shipments to vessels when they're needed. If your ship has more than one PR-1 or accelerometer, please send them to DLI at the address below. Keeping a spare PR-1 makes no sense either, as the calibration periodicity is only one year.

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